

EXHIBIT 2



Roger W. Griffith, P.E.

Forensic Mechanical Engineer

REBUTTAL REPORT

Circulation of PFAS in the Sediment of the Water Heaters to Residential Plumbing and Tap Water In the Class Area

Prepared for:
Cohen Millstein Sellers & Toll PLLC
and
Susman Godfrey LLP

Prepared by:
Roger W. Griffith, P.E.
P.O. Box 702
Jefferson City, TN 37760

Report Date: December 16, 2021

Roger W. Griffith, P.E.
State of North Carolina, Professional Engineer: No. 029286





A. INTRODUCTION

- 1 The purpose of this report is to respond to statements made in the expert reports of Shane A. Snyder, Ph.D., and of JR Flanders, that seek to contradict or take issue with the facts and opinions stated in my expert report dated July 2021. Both the Snyder and Flanders reports are dated October 28, 2021.
- 2 These expert reports do not address many of the opinions expressed in my expert report. Any unaddressed opinions are not restated in this report, but I reassert them as presented in my original report. This rebuttal report addresses only those statements or opinions in the expert reports that purport to express a contrary opinion to my findings.

B. Snyder Report

- 3 In Opinion No. 4, Mr. Snyder states that “PFAS is unlikely to accumulate in hot water heater tanks and premise plumbing.”
- 4 To support this opinion, the following arguments are made:
 1. *Mr. Snyder states that he can find no data that provides “demonstrated presence” of PFAS in water heater sediment.*

Response:

- 5 My report references samples collected from residential dwellings in June 2018/March 2019 and in August/October 2019 and analyzed for Fayetteville Works PFAS by GEL Laboratories, LLC. This sampling and analysis documented the presence of PFAS in the sediment of water heaters.
- 6 PFAS concentrations are also reported in the defendant’s Flanders Report.
- 7 *“Samples were collected in Fayetteville area homes following the installation of granular activated carbon(GAC) systems (Exhibit 2-B). These homes had unfiltered*



HFPO-DA concentrations in well water that were in excess of 140 ng/L, with averages ranging up to 1,320 ng/L.” - Flanders Report, p.10.

- 8 Storage-type water heaters have been in use since the early 1900s. Although many patents and designs have been invented over the years to reduce or minimize the sediment in water heater tanks, no water heater manufacturer has yet to claim that all the sediment can be removed from their water heaters. Information provided on 106 residences collected by Chemours note the presence of sediment after flushing the water heaters. All the water heaters in question have sediment as do all water heaters.
2. *Mr. Snyder notes that the sampling and testing referenced in my report shows that PFAS concentration in the sediment corresponds with the PFAS concentration in the water. From this data, he then extrapolates the conclusion that if/when the PFAS concentration in the water supply is reduced in the future, the PFAS concentration in the sediment will be reduced in a corresponding manner.*

Response:

- 9 No data is provided in the Snyder report to support this conclusion. Data referenced in my report has similar PFAS concentrations in the water and in the sediment, but to conclude that this will always be the case is unsupported.
- 10 To also conclude that the PFAS in the hot water system will match any future reduction of PFAS levels in the incoming water is also not supported with data. Changes in PFAS levels in the hot water system may be affected by the PFAS level of the incoming water, time intervals between any concentration changes to the incoming water, the amount of water usage in each system, and the amount of contaminant in the sediment. Data provided in Exhibit 2 from the Flanders Report documents higher concentrations of PFAS in the hot water than in the cold water.
- 11 What is clear from the testing thus far is that water contaminated with concentrations of PFAS has led to contaminated sediment in the water heaters. Sediment in water



heaters comes from the water supply and deterioration of the tank and is continually deposited with the operation of the water heater.

3. *Mr. Snyder argues that when water with low or non-detectable PFAS is introduced into the system, the equilibrium partitioning will change and PFAS in the sediment will quickly desorb.*

Response:

12 No data is provided to support this opinion. If the PFAS did desorb from the sediment into the water, the timing of this process and the amount of release could pose a safety concern to the home owners.

4. *PFAS will not have a high affinity to inorganic material in the sediment.*

Response:

13 My report gave examples of inorganic material that may be contained in sediment. However, there was no statement or conclusion that only inorganic material would be contained in the sediment.

5. *There is not a high mass of PFAS present in tanks based on the concentrations found during testing.*

Response:

14 The low concentration limits for acceptable PFAS levels are set by the EPA and the state of North Carolina. The very low acceptable concentration limits emphasize the critical nature of this contaminant. No data was provided to support the opinion that the mass corresponding to the PFAS concentrations found in water heater sediment do not create an unsafe condition for human consumption.

6. *Some residents are using tankless water heaters, which have no reservoir for sediment.*

Response:



15 Tankless water heaters do not store water and therefore do not accumulate sediment, except for tankless water heaters with integral buffer tanks. A small percentage of new residential water heater sales are tankless water heaters. This has no bearing on the fact that existing storage-type water heaters have been contaminated with PFAS and must be addressed.

7. *Hot water from the tap is not used for drinking.*

Response:

16 There are no prohibitions on people using hot water in kitchens and bathrooms. Hot water can be used for washing, drinking, cooking, and for coffee and tea consumption. No evidence of any prohibitions on drinking hot water has been provided. No substantiation of the statement that hot water is not used for drinking has been provided.

8. *In his report, Mr. Snyder states: “In Griffith point #28, in reference to Exhibit E-1, there is only one sample location where the hot water concentrations are significantly higher than the outside tap waters (sample ID ODEL page 6 of 14). The other samples shown in E-1 are not significantly different, other than several where the hot water concentrations are lower than the tap.”*

Response

17 What is meant by “significantly higher” concentrations is not explained.

18 Also, there are at least 12 locations shown in Exhibit E-1 of my report where the total PFAS concentrations are higher at the tank outlet (top) than at the tank inlet (bottom). Mr. Snyder infers that these increases in PFAS concentrations are not significantly higher. These 12 locations and their corresponding concentrations are shown below in the table below:



Sample Location	Inlet Conc. (ng/L)	Outlet Conc. (ng/L)	% Increase
WAMP	131	164	25
SAND	57 & 58	67 & 72	18 & 24
LEE	158 & 185	224	42 & 21
ODEL	272	360	32
ADAM	213	275	29
BOTS	140	154	10
HYAN	228	246	8
JAYB	89	138	55
LAUR	Non Detect	146	Very Significant
LULL	205	233	12
MASO	263	284	8
OYST	250	264	6

From Griffith Report, Exhibit E-1.

- 19 These increases in PFAS concentrations between the water heater tank inlets and outlets could be a result of de-sorption of PFAS compounds from sediment at the bottom of the tanks or possibly from the corrosion byproducts of the metal tank.
- 20 To summarize, I have found no evidence or peer reviewed research that demonstrates that all the sediment in a water heater can be removed or that all PFAS contamination in the sediment can be removed. To merely state that the known presence of PFAS in water heater sediment is unlikely to accumulate or create adverse health effects without documented proof is not adequate. In fact, according to data provided by Chemours in 106 residents establishes that: (1) all hot 106 water tanks sampled by Chemours have sediment, and (2) all hot water heaters have PFAS contamination exceeding the concentrations in cold water concentrations in most instances. Therefore, all water heaters should be replaced to eliminate water heaters as a source of ongoing PFAS contamination and exposure and to ensure that there are no adverse effects from PFAS.



C. JR FLANDERS REPORT

21 *Opinion #2: Contrary to the plaintiff's expert claims, PFAS concentrations decline quickly in response to treatment and recontamination does not occur. – p.9*

- The sediment is continuously stirred as the incoming water discharges through the dip tube into the bottom of the tank.
- Sampling water at one point in time does not confirm the absence of the release of PFAS from the sediment over a period of time.

22 Mr. Flanders also references data in Exhibit 2-C, which is from sampling of 32 homes in six counties. Samples were collected from the tap, water heater inlets, and water heater outlets to obtain information on the potential impact of surfaces on the PFAS levels (p.11).

County	Residence ID	HFPO-DA (ng/L)						Attachment C Compounds (ng/L)					
		Tap Water			Hot Water Heater			Tap Water			Hot Water Heater		
		First Flush	Follow Up	Change	Bottom	Top	Change	First Flush	Follow Up	Change	Bottom	Top	Change
Bladen	CHIC	32.8	41.4	26%	37.2	36.9	-1%	250	320	28%	289	286	-1%
	JACK	ND	ND	--				2.4	0				
	LIBE	27.7	25.1	-9%	25	25.2	1%	168	153	-9%	163	155	-5%
	RIVE	16.2	22.7	40%	20.9	20.35	-3%	101	135	33%	136	275	102%
	WAMP	19.8	26.3	33%	22.1	25.8	17%	123	148	20%	131	164	25%
	WATE	20.9	21.6	3%	20.7	20.3	-2%	127	128	1%	129	120	-7%
Brunswick	FOUR	21.5	32.2	50%	18	7.69	-57%	115	171	50%	109	43	-61%
	LEE	47.8	46.4	-3%	28.7	37.1	29%	232	239	3%	344	224	-35%
	ODEL	17.6	9.43	-46%	48.5	63.3	31%	86	49	-43%	272	360	33%
	SELL	52.4	54.2	3%	9.02	11.3	25%	293	293	0%	64	59	-8%
	GOOS	41.2	44.5	8%	33.6	33.1	-1%	243	253	4%	213	200	-6%
	GRAY	4.1	3.785	-8%	3.79	3.89	3%	88	188	114%	81	181	123%
Cumberland	HOOD	ND	ND	--	2.59	1.3	-50%	0	0		26	17	-35%
	MARS	26	24.3	-7%	18.4	21.9	19%	58	53	-8%	37	50	34%
	SAVA	30.2	29.8	-1%	32.8	33.1	1%	163	153	-6%	164	167	2%
	TABO_2	191	187	-2%	--	--		895	672	-25%			
	BONH	18	16.8	-7%	ND	ND	--	140	133	-5%	0	0	
	BOTS	20.2	19	-6%	16.8	18.8	12%	154	151	-2%	140	154	10%
New Hanover	JAYB	16.75	18.8	12%	12.3	16.2	32%	288	150	-48%	89	138	54%
	LAUR	20	19.2	-4%	ND	17.7	--	129	147	14%	0	146	
	ONEI	18.7	18.3	-2%	21.1	16.4	-22%	135	149	10%	155	145	-7%
	ADAM	40.3	40.2	0%	27.1	32.7	21%	248	238	-4%	213	275	29%
	ARBO	29.8	33	11%	28.3	26.3	-7%	247	274	11%	212	212	0%
	CARR	35.6	40.6	14%	--	--		269	275	2%			
Pender	HYAN	36.8	34.5	-6%	34.9	39.8	14%	249	244	-2%	228	246	8%
	ULL	44.2	35.7	-19%	27.8	29.7	7%	264	230	-13%	205	233	14%
	MASO	32.4	30.1	-7%	31.7	34.5	9%	270	251	-7%	263	284	8%
	OYST	28.4	29.1	2%	29.9	35	17%	226	232	3%	250	264	6%
	RAND	38.4	38.15	-1%	40.8	40.5	-1%	250	463	85%	260	253	-3%
	TREE	26.7	31.2	17%	--	--		188	245	31%			
	SHOR	ND	ND		ND	ND		0	0		0	0	
	WATH	ND	ND		ND	ND		0	0		58.4	34	-42%
		Average Change	3%	Minimum	-46%	Maximum	50%	Average Change	4%	Minimum	-57%	Maximum	32%
								Average Change	8%	Minimum	-48%	Maximum	114%
								Average Change	12%	Minimum	-61%	Maximum	123%

Exhibit 2-C: PFAS Concentrations in residential systems following a first flush, a follow-up sample collected 2 minutes after running the water, and at the bottom (inlet) and top (outlet) of the hot water heater.



- 23 Water was collected as a “First Draw” from the tap, and then after running the water for two minutes another “Follow Up” sample was collected. According to Mr. Flanders, this provided *“a robust analysis of the potential for transient increases due to the sloughing of biofilms and increases from desorption by running water over the surfaces in the system.”* The location of the tap water collection points is not provided and whether the water collected for the “First Draw” and “Follow Up” samples was cold or hot water is also not provided. Depending on the discharge location where the water was run for two minutes, this could represent as little as three to five gallons of water flowing out of the system. If hot water was run and collected, three to five gallons of hot water would only remove a small amount of water from the top portion of a standard 40 or 50-gallon water heater. This would not result in running water over the surfaces of the water heater tank to any measurable extent. This would not provide any reliable data related to the PFAS retention in the water heater sediment. The wide variation in results (-46% to +50% changes in PFAS concentrations between the “First Draw” and the Follow-Up” samples) most likely is evidence that a two-minute period of water flow is too short of a time period to provide any consistent, reliable information regarding transient increases (or decreases) in PFAS levels of biofilms and surfaces over time.
- 24 Comparison of PFAS concentrations in water samples from the water heater inlets and outlets was reported by Mr. Flanders to be a *“conclusive test of the effects of water heater scale on PFAS concentrations.”* (p.10). No details on the collection methods at the inlets and outlets are provided. PFAS levels from the sediment were not obtained in this analysis. Samples of water from the inlet and outlet of water heaters may not be indicative of the PFAS levels in the sediment. Samples of water taken from the inlet and outlet of water heaters at relatively the same point in time may also not provide reliable information regarding changes of PFAS levels in the sediment over a longer time period.